

# High Power Thin Film Wraparound Chip Resistor AEC-Q200 Qualified



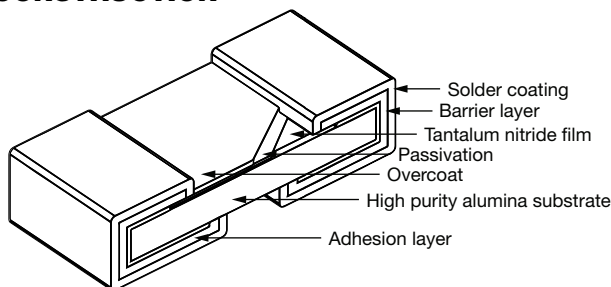
## LINKS TO ADDITIONAL RESOURCES



PHPA series chip resistors incorporate the self passivated enhanced tantalum nitride film to give superior moisture resistance, ESD, voltage coefficient, and resistance stability performance. They are designed with enlarged backside terminations to reduce the thermal resistance between the topside resistor layer and the solder joint on the end user's circuit board.

Actual power handling capability is limited by the end user mounting process. As with any high power chip resistor the ability to remove the generated heat is critical to the overall performance of the device.

## CONSTRUCTION



## FEATURES

- AEC-Q200 qualified
- ESD rating 5A (HBM)
- Moisture resistant
- High purity ceramic substrate
- Power rating to 2.5 W
- Resistance range 10  $\Omega$  to 30.1 k $\Omega$
- Resistor tolerance to  $\pm 0.1$  %
- TCR to  $\pm 25$  ppm/ $^{\circ}$ C
- Flame resistant UL 94 V-0
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**  
**GREEN**  
(5-2008)

## APPLICATIONS

- Power supplies
- Power switching
- Braking system
- Test and measurement equipment
- Motor deflection circuits

## TYPICAL PERFORMANCE

|      | ABSOLUTE |
|------|----------|
| TCR  | 25       |
| TOL. | 0.1      |

## STANDARD ELECTRICAL SPECIFICATIONS

| TEST                           | SPECIFICATIONS                                                        | CONDITIONS                            |
|--------------------------------|-----------------------------------------------------------------------|---------------------------------------|
| Material                       | Tantalum nitride                                                      | -                                     |
| Resistance Range               | 10 $\Omega$ to 30.1 k $\Omega$                                        | -                                     |
| TCR: Absolute                  | 25 ppm/ $^{\circ}$ C, 50 ppm/ $^{\circ}$ C, and 100 ppm/ $^{\circ}$ C | -55 $^{\circ}$ C to +155 $^{\circ}$ C |
| Tolerance: Absolute            | $\pm 0.1$ % to $\pm 5$ %                                              | +25 $^{\circ}$ C                      |
| Power Rating: Resistor         | 1 W to 2.5 W <sup>(1)</sup>                                           | Maximum at +70 $^{\circ}$ C           |
| Stability: Absolute            | $\Delta R$ 0.50 %                                                     | 4000 h at +70 $^{\circ}$ C            |
| Stability: Ratio               | Not applicable                                                        | -                                     |
| Voltage Coefficient            | < 0.1 ppm/V                                                           | -                                     |
| Working Voltage                | 200 V                                                                 | -                                     |
| Operating Temperature Range    | -55 $^{\circ}$ C to +155 $^{\circ}$ C                                 | -                                     |
| Storage Temperature Range      | -55 $^{\circ}$ C to +155 $^{\circ}$ C                                 | -                                     |
| Noise                          | < -30 dB                                                              | -                                     |
| Shelf Life Stability: Absolute | $\pm 0.01$ %                                                          | 1 year at +25 $^{\circ}$ C            |

### Note

(1) Dependent on component mounting by user

**COMPONENT RATINGS**

| CASE SIZE | POWER RATING (mW)   | WORKING VOLTAGE (V) | RESISTANCE RANGE ( $\Omega$ ) |
|-----------|---------------------|---------------------|-------------------------------|
| 1206      | 1000 <sup>(1)</sup> | 200                 | 12 to 30.1K                   |
| 2512      | 2500 <sup>(1)</sup> | 200                 | 10 to 30.1K                   |

**Note**

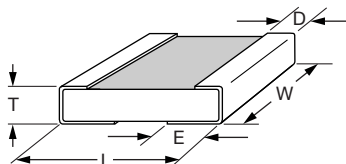
<sup>(1)</sup> Dependent on component mounting by user

**ENVIRONMENTAL TESTS** (Vishay Performance vs. AEC-Q200 Requirements)

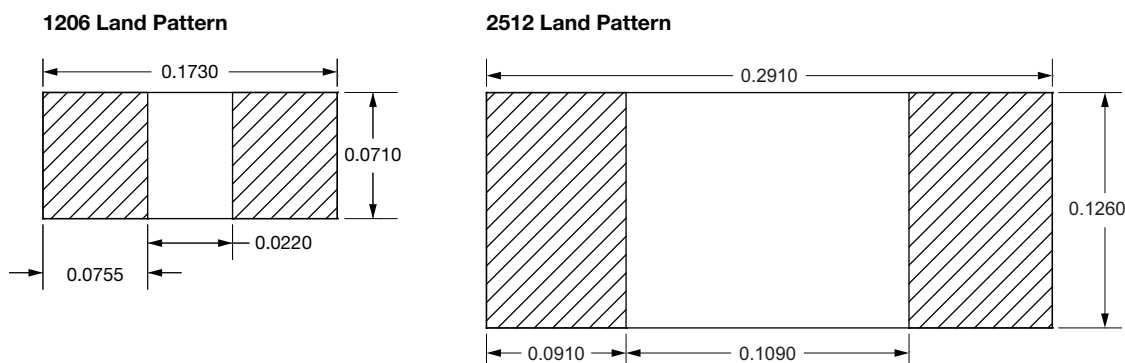
| ENVIRONMENTAL TEST                            | CONDITIONS                                             | TEST LIMITS     | TYPICAL VISHAY PERFORMANCE |
|-----------------------------------------------|--------------------------------------------------------|-----------------|----------------------------|
| Resistance Temperature Characteristic         | -55 °C to +155 °C                                      | $\pm 25$ ppm/°C | +11.5 ppm/°C               |
| Maximum Ambient Temperature at Rated Wattage  | See Derating Curve                                     |                 |                            |
| Maximum Ambient Temperature at Power Derating |                                                        |                 |                            |
| High Temperature Exposure $\Delta R$          | MIL-STD-202, method 108, 1000 h at 155 °C              | $\pm 0.2$ %     | +0.013 %                   |
| Temperature Cycling $\Delta R$                | JESD22, JA-104, 1000 cycles, -55 °C to 155 °C          | $\pm 0.25$ %    | +0.006 %                   |
| Biased Humidity $\Delta R$                    | MIL-STD-202, 103, 1000 h at 85 °C, 85 % RH, 10 % power | $\pm 1.0$ %     | +0.025 %                   |
| Life $\Delta R$                               | MIL-STD-202, 108, 2000 h at 70 °C, 100 % power         | $\pm 0.5$ %     | +0.060 %                   |
| Mechanical Shock $\Delta R$                   | MIL-STD-202, 213, condition C                          | $\pm 0.25$ %    | 0.000 %                    |
| Vibration $\Delta R$                          | MIL-STD-202, 204, 10 Hz to 2 kHz                       | $\pm 0.25$ %    | 0.000 %                    |
| Resistance to Soldering Heat $\Delta R$       | MIL-STD-202, 210, condition D                          | $\pm 0.25$ %    | +0.006 %                   |
| Electrostatic Discharge $\Delta R$            | AEC-Q200-002 > 8 kV                                    | $\pm 1.0$ %     | -0.098 %                   |
| Solderability Visual                          | J-STD-002, method B and B1                             | 95 %            | Acceptable                 |
| Terminal Strength $\Delta R$                  | AEC-Q200-006 at 1 kg for 60 s                          | $\pm 1.0$ %     | 0.000                      |
| Flame Retardance Visual                       | AEC-Q200-001, para 4.0                                 |                 | Acceptable                 |

**Note**

- Typical Vishay performance based on the data median

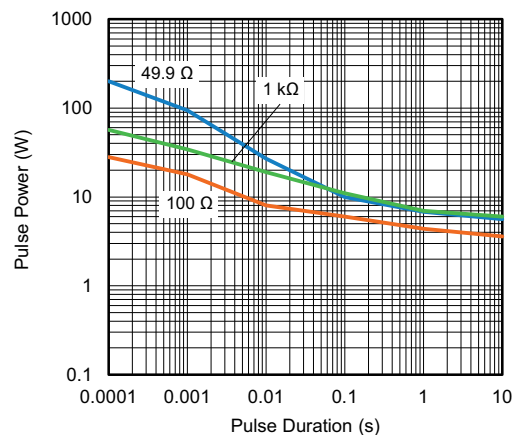
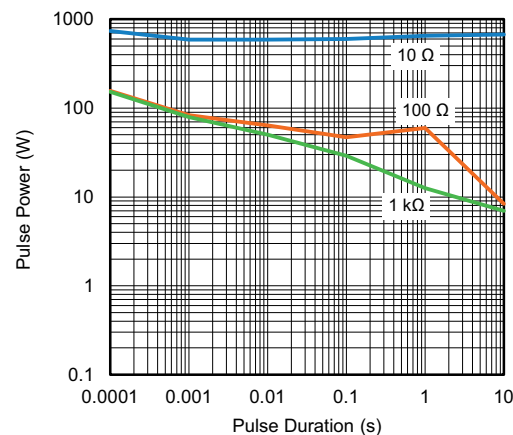
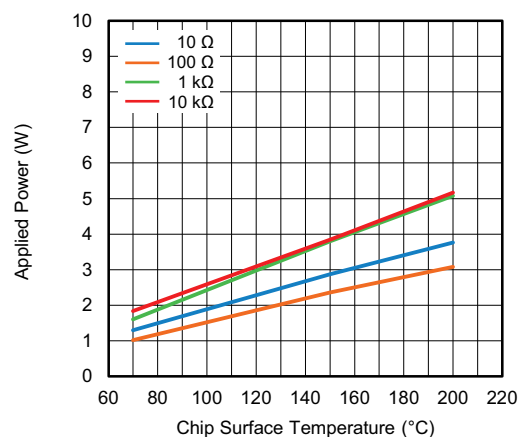
**DIMENSIONS** in inches


| CASE SIZE | LENGTH                | WIDTH W ( $\pm 0.005$ ) | THICKNESS MIN. / MAX. | TOP PAD D ( $\pm 0.005$ ) | BOTTOM PAD E ( $\pm 0.005$ ) |
|-----------|-----------------------|-------------------------|-----------------------|---------------------------|------------------------------|
| 1206      | 0.126 $\pm$ 0.008     | 0.063                   | 0.015 / 0.020         | 0.020                     | 0.040                        |
| 2512      | 0.259 + 0.009/- 0.015 | 0.124                   | 0.015 / 0.020         | 0.020                     | 0.050                        |

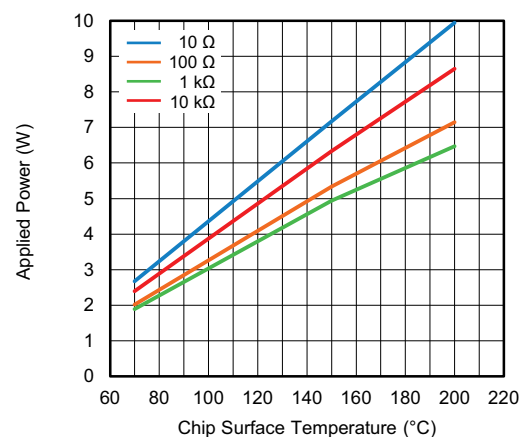
**LAND PATTERN DIMENSIONS** in inches


**STANDARD MATERIAL SPECIFICATIONS**

|                                      |                                           |
|--------------------------------------|-------------------------------------------|
| <b>Resistive Element</b>             | Tantalum nitride                          |
| <b>Substrate Material</b>            | Alumina (Al <sub>2</sub> O <sub>3</sub> ) |
| <b>Terminations (Lead (Pb)-Free)</b> | Tin solder plate over nickel barrier      |

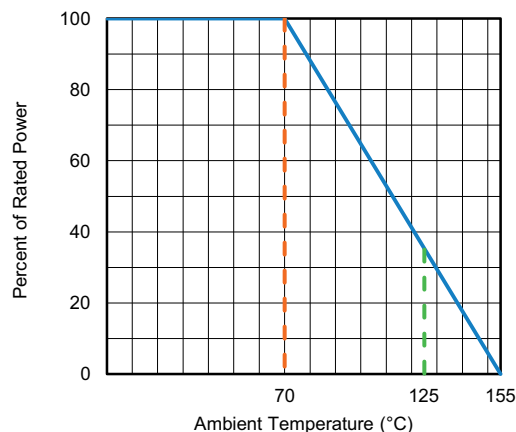
**PHPA1206 SINGLE PULSE CURVE****PHPA2512 SINGLE PULSE CURVE****PHPA1206 CHIP TEMP. VS. APPLIED POWER****Notes**

- Chip surface temperature measured using FLIR A40 thermal imaging system with an approximate test card surface temperature of 25 °C
- Thermal imaging was conducted under ambient conditions resulting in a steady state test card surface temperature of 85 °C over the full range of power levels
- Thermal imaging and load life testing was conducted mounting one device to 2" x 3" test cards with 2.5 mil copper plating on both surfaces. Thermal vias on 120 mil centers were utilized for heat transfer between surfaces of the test card

**PHPA2512 CHIP TEMP. VS. APPLIED POWER****Notes**

- Chip surface temperature measured using FLIR A40 thermal imaging system with an approximate test card surface temperature of 25 °C

|                         |                  |             |            |
|-------------------------|------------------|-------------|------------|
| <b>Case Size</b>        | 2512             | 2512        | 2512       |
| <b>Resistance Value</b> | Up to 10 Ω       | Up to 100 Ω | Up to 1 kΩ |
| <b>Temperature</b>      | <b>Power (W)</b> |             |            |
| 70                      | 2.67             | 2.02        | 1.89       |
| 150                     | 7.17             | 5.34        | 4.94       |
| 200                     | 9.94             | 7.15        | 6.48       |

**DERATING CURVE**

**GLOBAL PART NUMBER INFORMATION**

| P            | H            | P                                                      | A                                                                                                                                                                                                      | 1                                                                       | 2                                                                           | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 6 | E | 1 | 0 | 0 | 2 | B | S | T | 1 |
|--------------|--------------|--------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|-----------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|---|---|---|---|---|---|---|
| GLOBAL MODEL | CASE SIZE    | TCR <sup>(1)</sup>                                     | RESISTANCE                                                                                                                                                                                             | TOLERANCE                                                               | TERMINATION                                                                 | PACKAGING                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |   |   |   |   |   |   |   |   |   |   |
| PHPA         | 1206<br>2512 | E = ± 25 ppm/°C<br>H = ± 50 ppm/°C<br>K = ± 100 ppm/°C | The first 3 digits are significant figures and the last digit specifies the number of zeros to follow. "R" designates the decimal point.<br><br>Example:<br>10R0 = 10 Ω<br>1000 = 100 Ω<br>1001 = 1 kΩ | B = ± 0.1 %<br>D = ± 0.5 %<br>F = ± 1.0 %<br>G = ± 2.0 %<br>J = ± 5.0 % | S = wraparound<br>100 % electroplated pure matte tin<br>RoHS-compliant - e3 | BULK<br><b>BS</b> = 100 min., 1 mult.<br><br>WAFFLE<br><b>WS</b> = 100 min., 1 mult.<br><b>W0</b> = 100 min., 100 mult.<br><b>WI</b> = 100 min., 1 mult. <sup>(2)</sup><br><b>WP</b> = 100 min., 1 mult. <sup>(3)</sup><br><br>TAPE AND REEL<br><b>T0</b> = 100 min., 100 mult.<br><b>T1</b> = 1000 min., 1000 mult. <sup>(4)</sup><br><b>T3</b> = 300 min., 300 mult.<br><b>T5</b> = 500 min., 500 mult.<br><b>TF</b> = full reel<br><b>TS</b> = 100 min., 1 mult.<br><b>TI</b> = 100 min., 1 mult. <sup>(2)</sup><br><b>TP</b> = 100 min., 1 mult. <sup>(3)</sup> |   |   |   |   |   |   |   |   |   |   |

**Notes**

- (1) < 50 Ω "E" TCR characteristic is not available
- (2) Item single lot date code
- (3) Package unit single lot date code
- (4) Preferred packaging code



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